

What is claimed is:

1. A method of aligning the printing of dots generated by different nozzle banks of an inkjet printer apparatus comprising the steps of:

- (a) printing on a receiver medium a sequence of spaced discrete first dots from one nozzle bank having plural nozzles associated therewith;
- (b) printing on a receiver medium a sequence of spaced discrete second dots from a second nozzle bank having plural nozzles associated therewith, the second dots being spaced from the first dots and at least some of the second dots being located at distances closer to at least some of the first dots than the respective nozzle spacings between nozzles on the second nozzle bank which emitted the at least some of the second dots and the nozzles on the first nozzle bank that emitted the at least some of the first dots;
- (c) determining a placement error for the at least some of the second dots; and
- (d) adjusting alignment of the second nozzle bank in accordance with any errors determined in placement.

2. The method of claim 1 and wherein the first and second nozzle banks print different color inks.

3. The method of claim 1 and wherein the first and second nozzle banks print the same color ink.

4. The method of claim 1 and including scanning the first and second dots on the receiver medium or a reproduction thereof with a scanner to determine relative dot placement.

5. The method of claim 4 and wherein scanning of the dots on the receiver medium or a reproduction thereof is made by a scanner at a location separate from a carriage on the printer apparatus.

6. The method of claim 1 including digitizing an image of the dots using a digital camera.

7. The method of claim 1 and wherein the first and second nozzle banks move in order to provide dots at different locations on the receiver medium and some of the first and second dots are printed during different passes.

8. The method of claim 7 and wherein the first and second nozzle banks print different color inks.

9. The method of claim 7 and wherein the first and second nozzle banks print the same color ink.

10. The method of claim 7 and wherein at least one of the first and second nozzle banks prints ink of different drop sizes.

11. The method of claim 1 and wherein at least one of the first and second nozzle banks prints ink of different drop sizes.

12. The method of claim 11 and wherein steps (a) and (b) and (c) are repeated at different spacings of the nozzle banks to the receiver medium.

13. The method of claim 7 and wherein steps (a) and (b) and (c) are repeated at different spacings of the nozzle banks to the receiver medium.

14. The method of claim 1 and wherein steps (a) and (b) and (c) are repeated at different spacings of the nozzle banks to different receiver media.

15. The method of claim 1 and wherein at least some of the at least some of the second dots are printed during a different pass of movement of the nozzle banks than a pass used to print at least some of the first dots.

16. The method of claim 15 and wherein error is determined based on information about which nozzle printed which dot on which pass.

17. A calibration method of aligning the printing of dots generated by different nozzle banks of an ink jet printer apparatus, the method comprising the steps of:

(a) printing on a receiver medium a sequence of spaced discrete first dots of a first color from one nozzle bank having plural nozzles associated therewith, the first dots being printed in a predetermined pattern;

(b) printing on the receiver medium a sequence of spaced discrete second dots of a second color from a second nozzle bank having plural nozzles associated therewith, at least some of the second dots being printed within the pattern;

(c) generating through examination of the receiver medium or a reproduction thereof color information regarding the dots printed on the receiver medium;

(d) using the color information to identify locations of the second dots;

(e) determining placement errors for the at least some of the second dots;  
and

(f) adjusting alignment of the second nozzle bank in accordance with any errors determined in placement.

18. The method of claim 17 and wherein in step (c) a scanner scans the receiver medium at a location separate from a carriage on the printer apparatus.

19. The method of claim 17 and wherein the first and second nozzle banks move in order to provide dots at different locations on the receiver medium and for some of the at least some of the second dots are printed during one pass and others of the at least some of the second dots are printed during a different pass.

20. The method of claim 17 and wherein at least one of the first and second nozzle banks prints ink of different drop sizes on the receiver medium for the calibration operation.

21. The method of claim 20 and wherein steps (a) and (b) are repeated at different spacings of the nozzle banks to the receiver medium.

22. The method of claim 17 and wherein steps (a) and (b) are repeated at different spacings of the nozzle banks to the receiver medium.

23. The method of claim 17 and wherein error is determined based on information about which nozzle printed which dot on which pass.

24. The method of claim 17 and wherein the placement error is examined for possible error in rotation position of the second nozzle bank.

25. The method of claim 17 and wherein the rotation position of the second nozzle bank is determined relative to a predetermined relational point of rotation of the second nozzle bank.

26. The method of claim 17 and wherein adjustments to the alignment of the second nozzle bank is made automatically in response to determining the placement error.

27. The method of claim 17 and wherein adjustments to the alignment of the second nozzle bank are displayed on a display.

28. The method of claim 17 and wherein at least some of said at least some of the second dots printed within the pattern and printed by respective second nozzles in the second nozzle bank are closer to first dots in the pattern and printed by respective first nozzles on the first nozzle bank than the respective nozzle spacings between the second nozzles and the first nozzles.

29. A method of aligning the recording of pixels by different recording element banks of a printer apparatus comprising the steps of:

printing on a recording medium a predetermined pattern of discrete pixels by plural recording elements of each of at least first and second banks, each discrete pixel being printed by a single one of the recording elements;

removing the recording medium from the printer apparatus;

examining the recording medium or a reproduction thereof at a resolution of at least 500 DPI to derive electronic information relative to the location of pixels in the printed pattern;

processing the information to determine respective centers of the pixels;

determining errors in location of the determined centers of the pixels from where the centers should be if the banks were properly aligned;

determining needed adjustments of a bank or banks or recording elements in the bank or banks to improve alignment of the pixel recording by such bank or banks or recording elements in the bank or banks ; and

adjusting alignment of pixel recording by at least one bank or at least some of the recording elements therein in accordance with a determination of needed adjustments.

30. The method of claim 29 and wherein in the step of determining needed adjustment of a bank or recording elements therein a signal is provided related to a need for a rotational adjustment of the bank.

31. The method of claim 29 and wherein in the step of adjusting alignment of pixel recording by at least one bank or at least some of the recording elements therein alignment adjustment is made by pivoting the bank.

32. The method according to claim 29 and wherein the pattern of pixels is printed by multiple passes of at least one of the banks.

33. The method according to claim 32 and wherein the recording elements are ink jet nozzles and the pixels are dots.

34. The method according to claim 33 and wherein at least some of

second dots printed within a pattern on the recording medium and printed by respective second nozzles in a second nozzle bank are closer to first dots in the pattern and printed by respective first nozzles on the first nozzle bank than the respective nozzle spacings between the second nozzles and the first nozzles.

35. The method according to claim 29 and wherein adjustment of alignment of a bank is made by providing information relative to timing of actuations of recording elements that corrects for alignment error of a bank.

36. The method according to claim 29 and wherein the pixels are scanned by a color scanner to determine pixels of different colors.

37. A calibration method of aligning the printing of dots by different nozzle banks of an ink jet printer apparatus, the method comprising the steps of:

(a) printing on a receiver medium a sequence of spaced discrete first dots from one nozzle bank having plural nozzles associated therewith, the first dots being printed in a predetermined pattern;

(b) printing on the receiver medium a sequence of spaced discrete second dots from a second nozzle bank having plural nozzles associated therewith, at least some of the second dots being printed within the pattern;

(c) generating through examination of the receiver medium or a reproduction thereof information regarding the dots printed on the receiver medium;

(d) using the information to identify locations of the second dots;

(e) determining placement errors for the at least some of the second dots;

and

(f) adjusting alignment of the second nozzle bank in accordance with any errors determined in placement.

38. The method of claim 37 and wherein in step (f) adjustments in alignment of the second nozzle bank are made by adjusting timing of actuations of nozzles that corrects for alignment error of the second nozzle bank.

39. The method of claim 38 and wherein in step (f) different adjustments of timing of actuations of a nozzle in the second nozzle bank are provided for different drop sizes emitted by that nozzle to correct for alignment errors in the second nozzle bank.

40. The method of claim 37 and wherein in step (c) the receiver medium is scanned at a resolution of at least five times the diameter of the smallest dot printed thereon.

41. The method of claim 40 and wherein the first dots are printed in a different color from the second dots.

42. The method of claim 37 and wherein in step (d) locations of centroids of dots are determined.

43. The method of claim 37 and wherein the pattern of first and second dots is printed from a file formatted as a standardized graphic information file.

44. The method of claim 37 and wherein the first nozzle bank defines reference dot positions of dots printed during a single pass.

45. A method of aligning drops emitted by an ink jet printer having a nozzle that is capable of emitting drops of liquid of different drop sizes in response to different actuation signals to form different dots sizes on a recording medium, the method comprising:

providing different timings of initiating activation of the respective signals to an actuator associated with the nozzle so that in generating different drop sizes emitted by that nozzle and to correct for alignment errors in emitting drops of different sizes timing of initiating activation of the actuation signal for generating a drop of one drop size is provided with an adjustment relative to timing of initiating activation of an actuation signal of a second and different drop size.

46. A method of aligning drops emitted by an ink jet printer having a series of nozzles formed on a nozzle bank, the method comprising:  
generating plural discrete dots recorded by plural nozzles from the nozzle bank during multiple passes of the nozzle bank over a receiver medium, wherein at least some of the discrete dots are recorded during different passes and a discrete dot recorded by one nozzle during one pass is spaced on the receiver medium at a closer distance to a second discrete dot recorded by a second nozzle during a second pass than the spacing between the first and second nozzles on the nozzle bank;

determining error in placement of at least one of the discrete dots;

and

correcting error in recording of dots by the nozzle bank.

47. A method for correcting errors in recording by an ink jet printhead having a plurality of nozzles comprising:

moving the printhead relative to a recording medium and forming discrete dots on the recording medium during each of plural passes of movement of the printhead relative to the recording medium so that a particular nozzle forms a respective discrete dot during a respective pass;

analyzing the recording medium to determine locations of dots recorded in accordance with expected locations and in accordance with the respective pass in which the dots were recorded;

determining errors in locations of dots relative to expected locations for such dots; and

using determined errors to correct the recording of dots by the printhead.

48. A method for correcting errors in recording of dots by an ink jet printhead having plural nozzles, the method comprising:

generating an image file of discrete dots to be recorded by the printhead, the file being in a standardized graphic display file format;



printing the discrete dots on a receiver medium in plural passes of the inkjet printhead;

determining errors in placement of dots by respective nozzles; and

providing adjustments in alignment of the printhead or in firing times of the nozzles to correct for the errors.

49. A method for correcting errors in recording of dots by an ink jet printhead having plural nozzles, the method comprising:

forming discrete dots from respective nozzles in each of plural passes on a receiver medium, a spacing of the receiver medium from the printhead during one pass being different from a spacing of the receiver medium from the printhead during a second pass;

determining errors in placement of dots by respective nozzles for the one pass and the second pass; and

providing adjustments in alignment of the printhead or in firing times of the nozzles to correct for the errors.

50. A method for correcting errors in recording of dots by an ink jet printhead having plural nozzles, the method comprising:

forming discrete dots from respective nozzles in each of plural passes on a receiver medium, a speed of the printhead relative to the receiver medium during one pass being different from a speed of the printhead relative to the receiver medium during a second pass;

determining errors in placement of dots by respective nozzles for the one pass and the second pass; and

providing adjustments in alignment of the printhead or in firing times of the nozzles to correct for the errors.

51. The method of claim 1 and wherein the first and second nozzle banks emit ink of the same color and both of the first and second nozzle banks are supported on a carriage for movement in the fast scan direction and the first and

second nozzle banks are separated in the fast scan direction by additional nozzle banks that emit inks of different colors than said same color.